Anatomy of Kubernetes Operators for Databases

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1. Intro

Why Operators

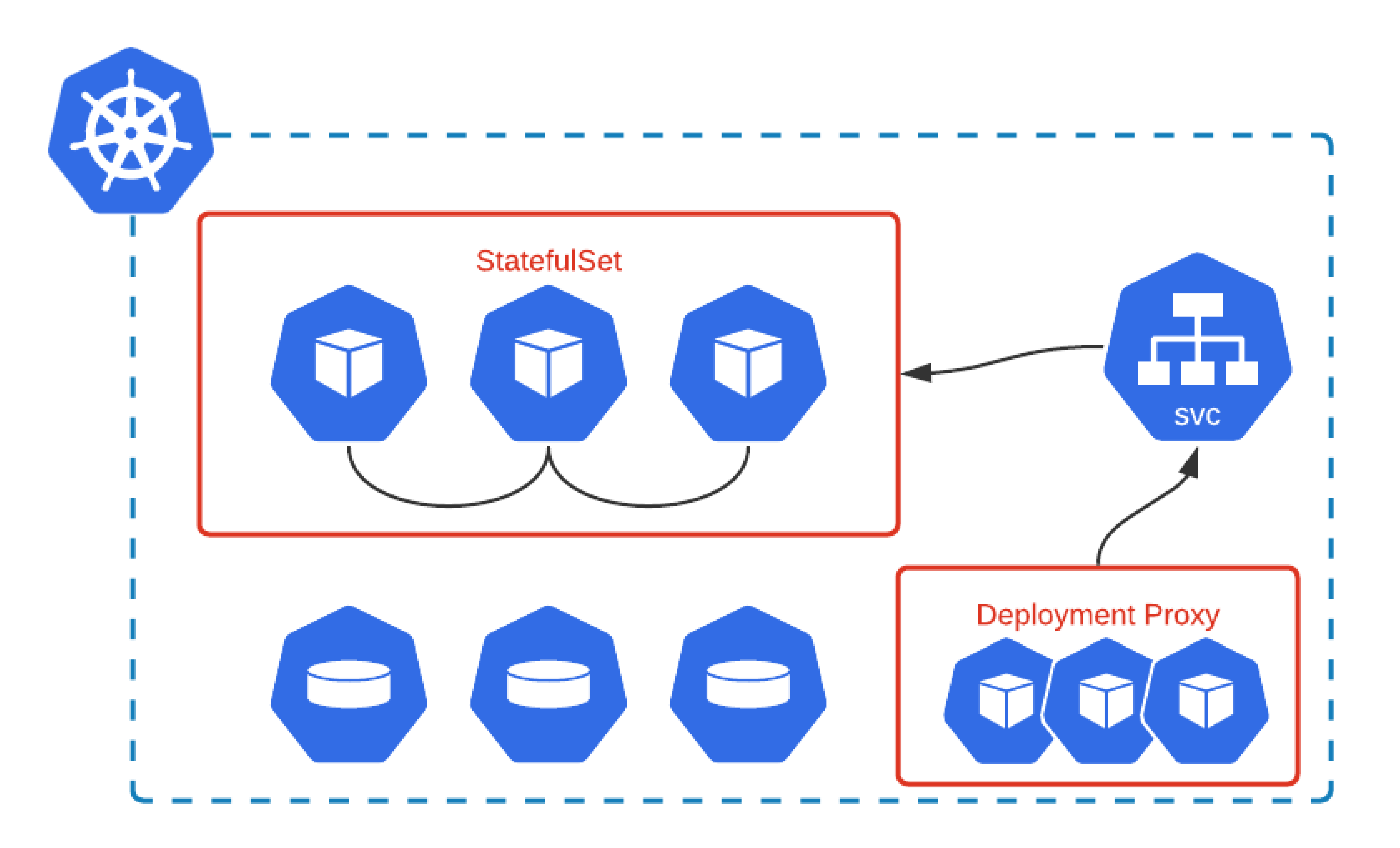
- Customer-Driven Decision
- Containers=Kubernetes
- Operators = Simplification + Automation
  - Deployment
  - Management
- Percona Database-as-a-Service
  - On-prem or Cloud
  - Deploy on k8s

Why Operators for DBs

- Cluster management is hard
  - K8S + database configuration is harder
  - Lots of things can go wrong
- Deployment is not enough, think operations
- It is not only DB
  - Proxy
  - Backups
  - Monitoring

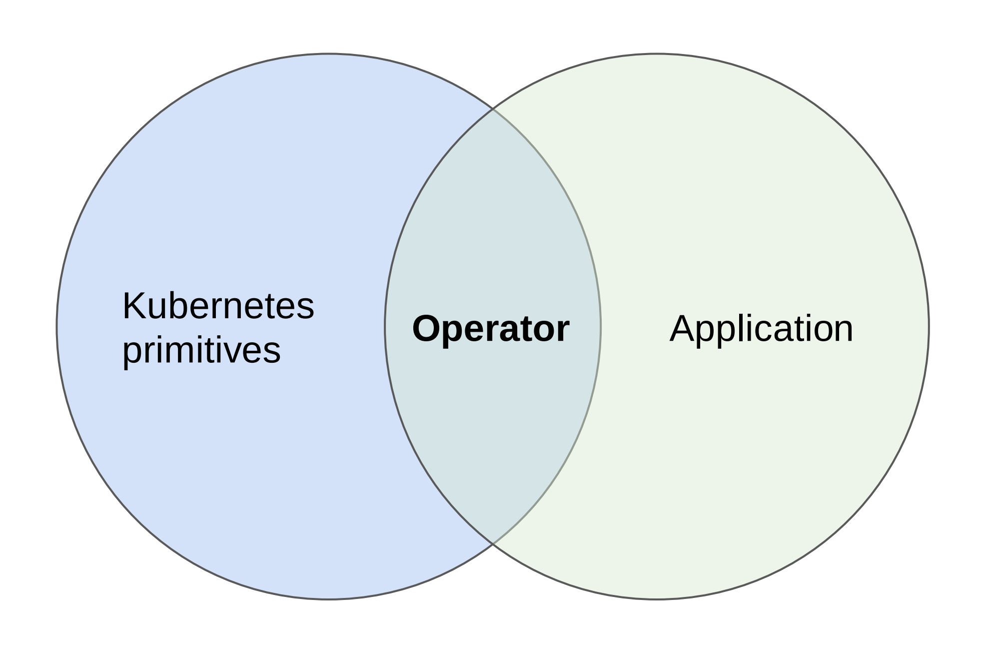
2. The Hows

Day 1 Operations - No Operator



1. Kubernetes
2. StatefulSet
   a. DB Replication
   b. Sustain
      i. No downtime
      ii. Automate recovery
3. Storage (PVC/Hostpath)
4. Service
   a. Readers and writers
   b. Query caching
5. Proxy
   a. HA
   b. Configure
6. Other
   a. Customize DB
   b. SSL, ...

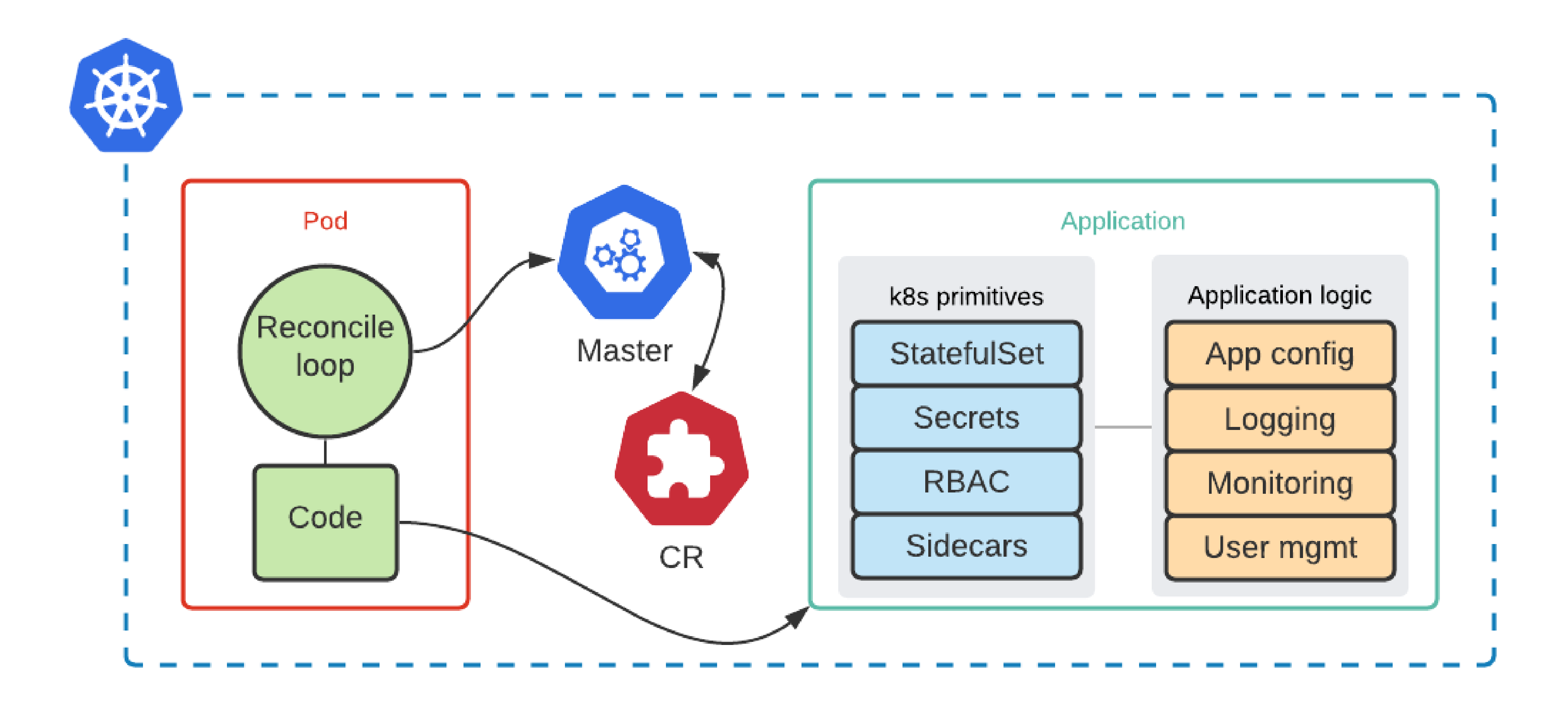
Day 1 Operations - Operator



- Operator = Application + Kubernetes primitives
- Just give it the instructions

```
metadata:
  name: my-cluster
spec:
  pxc:
    size: 3
    image: percona/percona-xtradb-cluster:8.0.22-
13.1
    affinity:
    annotation:
    resources:
    volumeSpec:
  haproxy:
    size: 3
    configuration:
      ...
```

Operator - internals

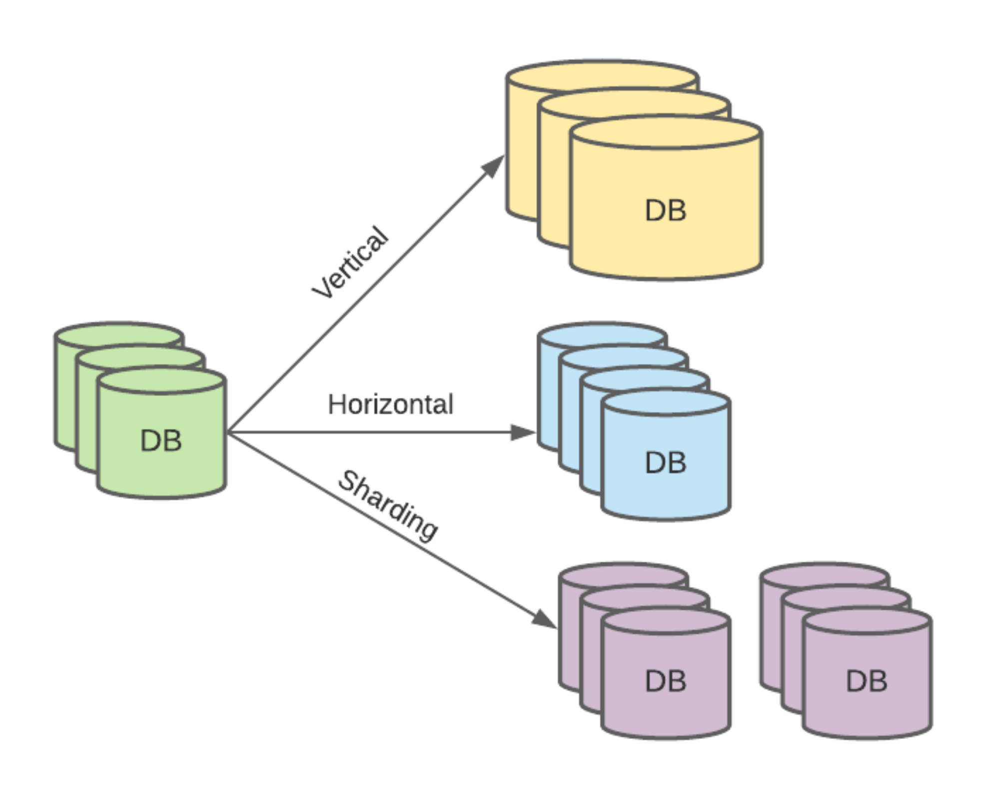


Day 2 Operations - Summary

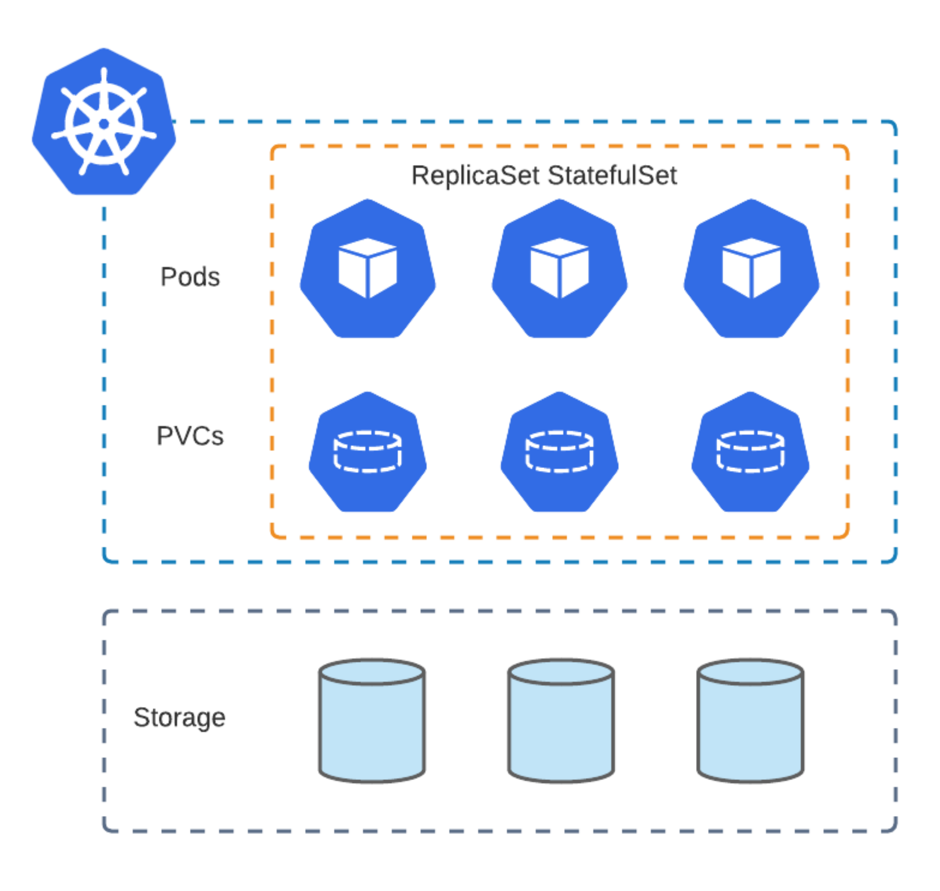
- Reliability Engineering tasks
- Backup/Restore operations
- Scaling
- Upgrade
  - Operator
  - Database
  - Components (proxy, monitoring)
- DYI Database-as-a-Service

Day 2 Operations - Scaling

CPU/Mem

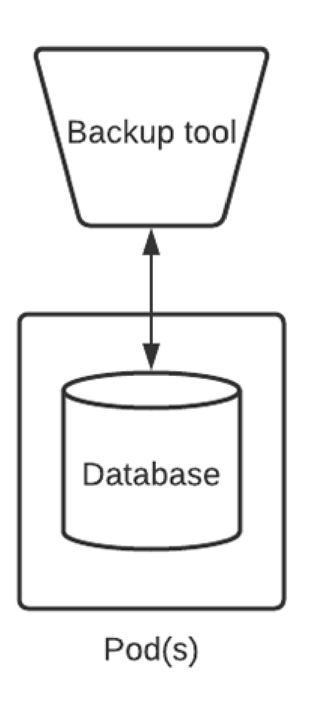


Storage

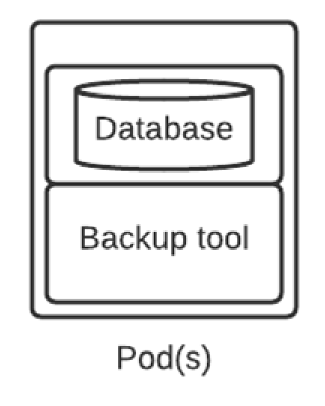


Day 2 Operations - backup / restore

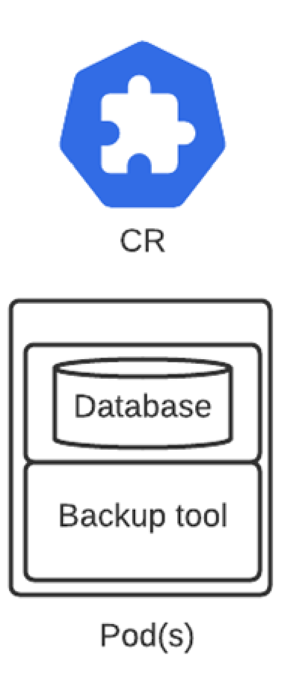
External backup



Sidecar

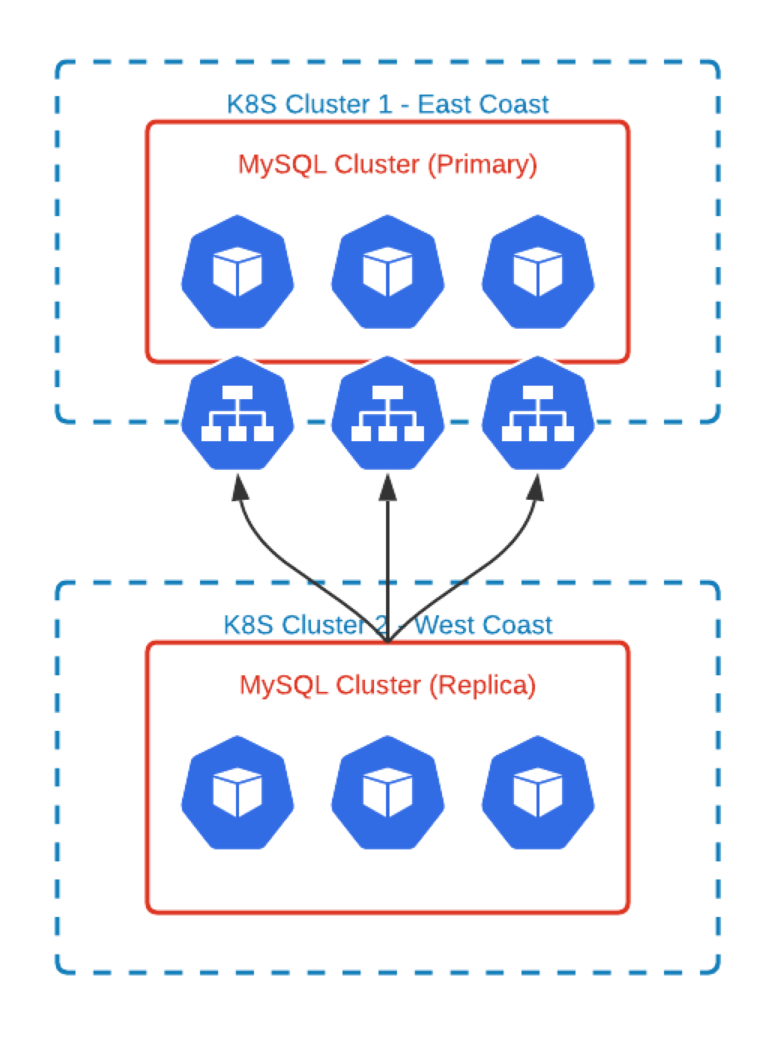


Custom Resource



Day 2 Operations - Disaster Recovery

- Restore from backup
  - Without Custom Resource
- Replication
  - Kubernetes level
    - Availability Zones
    - Regional clusters
    - Federation
  - Data replication
    - Operator per k8s cluster



Going multi-cloud

- Multi-cloud is a strategy
- Multi-cloud DBs is hard
  - Lock in on other services
  - Incompatibilities on DB engine/plugin level
- K8S does not change
  - Underlying infra does, but it is abstracted





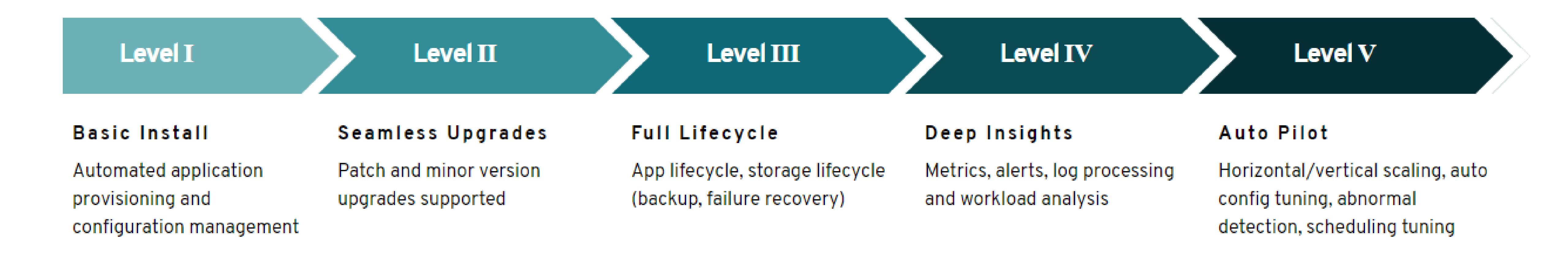


Why not the cloud?

- Cost
- Vendor lock-in
- Multi-cloud
- Open source as a strategy

3. Summary

Operators Capability Levels



Percona Operators check out on all levels, but not all items

Summary

- Containers everywhere
- Databases on Kubernetes are hard
  - ~10 Pods, 20+ containers for one cluster
- Operators simplify management
  - Kubernetes primitives
  - Databases and components

Plans for the Operators

- Feature parity
- Multi-cluster
- DBaaS integration
- PostgreSQL - polish and polish
- MySQL - v2 with async and Group Replication

Public Roadmap: https://github.com/percona/roadmap/projects/1



Any Questions?

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